

Complete Summary

GUIDELINE TITLE

Urinary tract infection in children: diagnosis, treatment and long-term management.

BIBLIOGRAPHIC SOURCE(S)

National Collaborating Centre for Women's and Children's Health. Urinary tract infection in children: diagnosis, treatment and long-term management. London (UK): National Institute for Health and Clinical Excellence (NICE); 2007 Aug. 148 p. (Clinical guideline; no. 54). [271 references]

GUIDELINE STATUS

This is the current release of the guideline.

COMPLETE SUMMARY CONTENT

SCOPE
 METHODOLOGY - including Rating Scheme and Cost Analysis
 RECOMMENDATIONS
 EVIDENCE SUPPORTING THE RECOMMENDATIONS
 BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS
 QUALIFYING STATEMENTS
 IMPLEMENTATION OF THE GUIDELINE
 INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT
 CATEGORIES
 IDENTIFYING INFORMATION AND AVAILABILITY
 DISCLAIMER

SCOPE

DISEASE/CONDITION(S)

Urinary tract infection

GUIDELINE CATEGORY

Diagnosis
 Evaluation
 Management
 Risk Assessment
 Treatment

CLINICAL SPECIALTY

Family Practice
Infectious Diseases
Internal Medicine
Nephrology
Pediatrics
Surgery
Urology

INTENDED USERS

Advanced Practice Nurses
Health Care Providers
Nurses
Patients
Physician Assistants
Physicians
Public Health Departments

GUIDELINE OBJECTIVE(S)

To provide guidance on the following:

- When to consider the diagnosis of urinary tract infection (UTI) in sick and/or symptomatic children who were previously healthy
- When and how to collect urine for the diagnosis of UTI in children
- Which tests establish or exclude UTI as the cause of illness in children
- How to treat sick and/or symptomatic children, including:
 - When to admit to hospital
 - When to start treatment
 - Which antibiotics to use
 - What route of administration to use
 - How long to treat
- How and when to treat symptomatic re-infection
- When to use prophylactic antibiotics, which antibiotics to use, and when to stop them
- When to use investigations to assess the structure and function of the urinary tract
- When to refer to secondary and tertiary care
- When to offer surgical intervention
- When to do long-term follow-up
- What advice to give carers and parents, including what to do if another UTI occurs

TARGET POPULATION

Children with urinary tract infection

Note: Areas outside of the remit of the guideline include:

- Children with urinary catheters *in situ*
- Children with neurogenic bladders
- Children already known to have significant pre-existing uropathies

- Children with underlying renal disease (for example, nephrotic syndrome)
- Immunosuppressed children
- Infants and children in intensive care units
- Preventative measures or long-term management of sexually active girls with recurrent UTI

INTERVENTIONS AND PRACTICES CONSIDERED

Diagnosis/ Evaluation

1. Assessment of signs and symptoms of urinary tract infection (UTI)
2. Assessment of risk of serious illness
3. Urine collection (e.g., clean catch sample, urine collection pads, catheter sample, suprapubic aspiration)
4. Urine sample preservation
5. Diagnostic urine-testing
 - Microscopy and culture
 - Dipstick (nitrite and leukocyte esterase [LE])
6. History and physical examination
7. Risk assessment for underlying serious pathology for confirmed UTI
8. Imaging as indicated (Doppler ultrasound, dimercaptosuccinic acid [DMSA] scintigraphy, micturating cystourethrogram [MCUG] [with prophylactic antibiotics])

Management/Treatment

Acute Management

1. Infants and children 3 months or older with acute pyelonephritis/upper urinary tract infection
 - Referral to secondary care
 - Oral or intravenous antibiotics (e.g., cephalosporin, co-amoxiclav, cefotaxime, ceftriaxone)
2. Infants and children 3 months or older with cystitis/lower urinary tract infection
 - Oral antibiotics (e.g., trimethoprim, nitrofurantoin, cephalosporin or amoxicillin)
 - Reassessment after 24–48 hours (if infant or child is still unwell)
 - Urine sample culture and antibiotic sensitivity testing
 - Aminoglycosides (e.g., gentamicin or amikacin)
 - Intramuscular antibiotics as indicated

Long-term Management

1. Management and treatment of dysfunctional elimination syndromes and constipation
2. Encouragement of children with previous UTI to drink an adequate amount
3. Avoidance of delayed voiding
4. Antibiotic prophylaxis
5. Follow-up by pediatric specialist and/or pediatric nephrologists as indicated
6. Assessment of infants and children with renal parenchymal including height, weight, blood pressure and routine testing for proteinuria

7. Provision of appropriate information and advice to patients, parents and carers

MAJOR OUTCOMES CONSIDERED

- Incidence of urinary tract infection (UTI)
- Rate of recurrence of UTI
- Rate of renal scarring
- Sensitivity and specificity of diagnostic tests
- Effectiveness of treatment
- Long-term complications
- Adverse outcomes of treatment or investigation
- Cost-effectiveness of treatment or investigation

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Literature Search Strategy

Initial scoping searches were executed to identify relevant guidelines (local, national, and international) produced by other development groups. The reference lists in these guidelines were checked against subsequent searches to identify missing evidence.

Relevant published evidence to inform the guideline development process and answer the clinical questions was identified by systematic search strategies. Additionally, stakeholder organizations were invited to submit evidence for consideration by the Guideline Development Group (GDG) provided it was relevant to the clinical questions and of equivalent or better quality than evidence identified by the search strategies.

Systematic searches to answer the clinical questions formulated and agreed by the GDG were executed using the following core databases via the OVID platform: MEDLINE (1966 onwards), Cochrane Central Register of Controlled Trials (2nd quarter 2006), Cochrane Database of Systematic Reviews (2nd quarter 2006), Database of Abstracts of Reviews of Effects (2nd quarter 2006), Embase (1980 onwards), and Cumulative Index to Nursing and Allied Health Literature (1982 onwards). Other databases, also via the OVID platform, utilised for specific questions were PsycINFO (1967 onwards) and Allied and Complementary Medicine Database (Datastar, 1985 onwards).

Search strategies combined relevant controlled vocabulary and natural language in an effort to balance sensitivity and specificity. Unless advised by the GDG, searches were not date specific (e.g., the search for antibiotic treatment for symptomatic urinary tract infection [UTI] was restricted to studies published since

1986). Both generic and specially developed methodological search filters were used appropriately.

Searches were not restricted by language but non-English papers were only translated where they were identified as highly significant to the clinical question or a paucity of equivalent quality English language research meant the clinical question could not be addressed any other way.

Searches to identify economic studies were undertaken using the above databases and the NHS Economic Evaluations Database (NHS EED) produced by the Centre for Reviews and Dissemination at the University of York.

There was no systematic attempt to search grey literature (conferences, letters, abstracts, theses, and unpublished trials). Hand searching of journals not indexed on the databases was not undertaken.

At the end of the guideline development process searches were updated and re-executed, thereby including evidence published and included in the databases up to 1 June 2006. The searches for effectiveness of imaging tests were conducted on 10 January 2007. Any evidence published after this date was not included. These dates should be considered the starting point for searching for new evidence for future updates to this guideline.

NUMBER OF SOURCE DOCUMENTS

Not stated

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Levels of Evidence for Intervention Studies

Level of Evidence	Type of Evidence
1++	High-quality meta-analyses, systematic reviews of randomised controlled trials (RCTs), or RCTs with a very low risk of bias
1+	Well-conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias
1–	Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias ^a
2++	High-quality systematic reviews of case-control or cohort studies High-quality case-control or cohort studies with a very low risk of confounding, bias or chance and a high probability that the relationship is causal
2+	Well-conducted case-control or cohort studies with a low risk of confounding, bias or chance and a moderate probability that the relationship is causal

Level of Evidence	Type of Evidence
2–	Case-control or cohort studies with a high risk of confounding, bias, or chance and a significant risk that the relationship is not causal ^a
3	Non-analytic studies (for example, case reports, case series)
4	Expert opinion, formal consensus

Levels of Evidence for Studies of the Accuracy of Diagnostic Tests

Levels of Evidence	Type of Evidence
<u>Ia</u>	Systematic review (with homogeneity) ^a of level-1 studies ^b
<u>Ib</u>	Level-1 studies ^b
<u>II</u>	Level-2 studies ^c Systematic reviews of level-2 studies
<u>III</u>	Level-3 studies ^d Systematic reviews of level-3 studies
<u>IV</u>	Consensus, expert committee reports or opinions and/or clinical experience without explicit critical appraisal; or based on physiology, bench research or 'first principles'

^a Homogeneity means there are no or minor variations in the directions and degrees of results between individual studies that are included in the systematic review.

^b Level-1 studies are studies that use a blind comparison of the test with a validated reference standard (gold standard) in a sample of patients that reflects the population to whom the test would apply.

^c Level-2 studies are studies that have **only one** of the following:

- Narrow population (the sample does not reflect the population to whom the test would apply)
- Use a poor reference standard (defined as that where the 'test' is included in the 'reference', or where the 'testing' affects the 'reference')
- The comparison between the test and reference standard is not blind
- Case-control studies

^d Level-3 studies are studies that have **at least two or three** of the features listed for level-2 studies.

METHODS USED TO ANALYZE THE EVIDENCE

Meta-Analysis
Review of Published Meta-Analyses
Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Synthesis of Clinical Effectiveness Evidence

Evidence relating to clinical effectiveness was reviewed using established guides and classified using the established hierarchical system described in the table titled "Levels of Evidence for Intervention Studies" in the "Rating Scheme for the Strength of the Evidence" field, above. This system reflects the susceptibility to bias that is inherent in particular study designs.

The type of clinical question dictates the highest level of evidence that may be sought. In assessing the quality of the evidence, each study receives a quality rating coded as '++', '+' or '-'. For issues of therapy or treatment, the highest possible evidence level (EL) is a well-conducted systematic review or meta-analysis of randomised controlled trials (RCTs) (EL = 1++) or an individual RCT (EL = 1+). Studies of poor quality are rated as '-'. Usually, studies rated as '-' should not be used as a basis for making a recommendation, but they can be used to inform recommendations. For issues of prognosis, the highest possible level of evidence is a cohort study (EL = 2-).

For each clinical question, the highest available level of evidence was selected. Where appropriate, for example, if a systematic review, meta-analysis or RCT existed in relation to a question, studies of a weaker design were not included. Where systematic reviews, meta-analyses, and RCTs did not exist, other appropriate experimental or observational studies were sought. For diagnostic tests, test evaluation studies examining the performance of the test were used if the efficacy of the test was required, but where an evaluation of the effectiveness of the test in the clinical management of patients and the outcome of disease was required, evidence from RCTs or cohort studies was used.

The system described above covers studies of treatment effectiveness. However, it is less appropriate for studies reporting diagnostic tests of accuracy. In the absence of a validated ranking system for this type of test, National Institute for Health and Clinical Excellence (NICE) has developed a hierarchy for evidence of accuracy of diagnostic tests that takes into account the various factors likely to affect the validity of these studies (see table titled "Levels of Evidence for Studies of the Accuracy of Diagnostic Tests" in the "Rating Scheme for the Strength of the Evidence" field, above).

Staff from the National Collaborating Centre for Women's and Children's Health (NCC-WCH) provided methodological support for the guideline development process, undertook systematic searches, retrieved and appraised literature and wrote systematic reviews. The Guideline Development Group (GDG) appraised and edited the systematic reviews and generated evidence statements and recommendations based on their content.

For economic evaluations, no standard system of grading the quality of evidence exists. Economic evaluations that are included in the review have been assessed using a quality assessment checklist based on good practice in decision-analytic modelling.

Evidence was synthesised qualitatively by summarising the content of identified papers in evidence tables and agreeing brief statements that accurately reflected the evidence. Quantitative synthesis (meta-analysis) was performed where appropriate.

Summary results and data are presented in the guideline text. More detailed results and data are presented in the evidence tables on the CD-ROM accompanying the original guideline document. Where possible, dichotomous outcomes are presented as relative risks (RRs) with 95% confidence intervals (CIs), and continuous outcomes are presented as mean differences with 95% CIs or standard deviations (SDs). Meta-analyses based on dichotomous outcomes are presented as pooled odds ratios (ORs) with 95% CIs, and meta-analyses based on continuous outcomes are presented as weighted mean differences (WMDs) with 95% CIs.

Health Economics

The aim of the economic input into the guideline was to inform the GDG of potential economic issues relating to urinary tract infection (UTI) in children.

The health economist helped the GDG by identifying topics within the guideline that might benefit from economic analysis, reviewing the available economic evidence and, where necessary, conducting (or commissioning) economic analysis. Reviews of published health economic evidence are presented alongside the reviews of clinical evidence where appropriate. Where no published economic evidence was available to inform the GDG in their decision making, the health economist advised the GDG on the potential impact on resource use resulting from the recommendations made in the guideline.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)
Expert Consensus (Nominal Group Technique)
Informal Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Forming and Grading Recommendations

For each clinical question, recommendations were derived using, and explicitly linked to, the highest available evidence that supported them. In the first instance, informal consensus methods were used by the GDG to agree evidence statements and recommendations. Shortly before the consultation period, formal consensus methods were used to agree guideline recommendations (modified Delphi technique) and to select 5–10 key priorities for implementation (nominal group technique).

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A systematic review of the economic evidence relating to the diagnosis and treatment of urinary tract infections (UTIs) was identified as part of a health

technology assessment (HTA) on the diagnosis and management of UTI. The review identified only one study that met the inclusion criteria for economic evaluations. The review concluded that the findings of this one study were of limited value for the National Health Service (NHS) setting as results were not expressed in quality-adjusted life years (QALYs), some parameter estimates were based on data from the USA and may not be valid in the context of the NHS, probabilistic sensitivity analysis for exploring uncertainty was not undertaken, and it did not consider the full range of diagnostic strategies available in an NHS setting. However, the economic model identified in the review did provide a basis for developing the subsequent economic model developed specifically for the health technology assessment.

The cost-effectiveness model developed for the health technology assessment attempted to identify the optimal strategy for the diagnosis and treatment of UTI in the NHS to prevent long-term complications believed to be associated with the illness. It should be noted from the outset that this economic model was based on clinical evidence of the risk of developing established renal failure (ERF) that is now considered to be out of date by the Guideline Development Group (GDG) and on specific assumptions which are not accepted as correct by the GDG. Therefore the economic model is described here to provide an account of the economic evidence which has been developed in the UK to date, although the GDG did not consider it to be adequate to support decision making. An update of the economic model to include more recent clinical evidence (specifically on the risk of ERF) and more realistic assumptions was considered for this guideline. However, because it was not possible to estimate the true risks of ERF, it was not possible to produce a more up-to-date economic model at this time.

The economic model developed specifically for the HTA examines the health outcomes and costs for a range of diagnosis and treatment strategies over the long term. Health outcomes in the model are expressed in terms of decrements in a patient's quality-adjusted life expectancy, with costs estimated from an NHS perspective and discounted in line with National Institute for Health and Clinical Excellence (NICE) technical guidance (6% for costs). Probabilistic sensitivity analysis was undertaken to explore the uncertainty in the values used in the model.

See Chapter 8 titled "Economic Evaluation of Management of UTI" in the original guideline document for more detail.

METHOD OF GUIDELINE VALIDATION

External Peer Review
Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The guideline was validated through two consultations.

1. The first draft of the guideline (The full guideline, National Institute for Clinical Excellence [NICE] guideline and Quick Reference Guide) were consulted with Stakeholders and comments were considered by the Guideline Development Group (GDG)

2. The final consultation draft of the Full guideline, the NICE guideline and the Information for the Public were submitted to stakeholders for final comments.

The final draft was submitted to the Guideline Review Panel for review prior to publication.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Diagnosis

Symptoms and Signs

Infants and children presenting with unexplained fever of 38 degrees C or higher should have a urine sample tested after 24 hours at the latest.

Infants and children with an alternative site of infection should not have a urine sample tested. When infants and children with an alternative site of infection remain unwell, urine testing should be considered after 24 hours at the latest.

Infants and children with symptoms and signs suggestive of urinary tract infection (UTI) should have a urine sample tested for infection. The Table below is a guide to the symptoms and signs that infants and children present with.

Table. Presenting Symptoms and Signs in Infants and Children with UTI

Age Group		Signs and Symptoms		
		Most Common	<----- --->	Least Common
Infants younger than 3 months		Fever Vomiting Lethargy Irritability	Poor feeding Failure to thrive	Abdominal pain Jaundice Haematuria Offensive urine
Infants and children, 3 months or older	Preverbal	Fever	Abdominal pain Loin tenderness Vomiting Poor feeding	Lethargy Irritability Haematuria Offensive urine

Age Group		Signs and Symptoms		
		Most Common	<----- --->	Least Common
				Failure to thrive
	Verbal	Frequency Dysuria	Dysfunctional voiding Changes to continence Abdominal pain Loin tenderness	Fever Malaise Vomiting Haematuria Offensive urine Cloudy urine

Assessment of Risk of Serious Illness

The illness level in infants and children should be assessed in accordance with recommendations in "Feverish illness in children" (NICE clinical guideline 47).

Urine Collection

A clean catch urine sample is the recommended method for urine collection. If a clean catch urine sample is unobtainable:

- Other non-invasive methods such as urine collection pads should be used. It is important to follow the manufacturer's instructions when using urine collection pads. Cotton wool balls, gauze, and sanitary towels should not be used to collect urine in infants and children.
- When it is not possible or practical to collect urine by non invasive methods, catheter samples or suprapubic aspiration (SPA) should be used.
- Before SPA is attempted, ultrasound guidance should be used to demonstrate the presence of urine in the bladder.

In an infant or child with a high risk of serious illness it is highly preferable that a urine sample is obtained; however, treatment should not be delayed if a urine sample is unobtainable.

Urine Preservation

If urine is to be cultured but cannot be cultured within 4 hours of collection, the sample should be refrigerated or preserved with boric acid immediately.

The manufacturer's instructions should be followed when boric acid is used to ensure the correct specimen volume to avoid potential toxicity against bacteria in the specimen.

Urine Testing

The urine-testing strategies shown in the Tables below are recommended.*

As with all diagnostic tests there will be a small number of false negative results; therefore clinicians should use clinical criteria for their decisions in cases where urine testing does not support the findings.

*Assess the risk of serious illness in line with "Feverish illness in children" (NICE clinical guideline 47) to ensure appropriate urine tests and interpretation, both of which depend on the child's age and risk of serious illness.

Table. Urine-testing Strategy for Infants Younger Than 3 Months

All infants younger than 3 months with suspected UTI (see the Table above titled "Presenting Symptoms and Signs in Infants and Children with UTI") should be referred to paediatric specialist care and a urine sample should be sent for urgent microscopy and culture. These infants should be managed in accordance with the recommendations for this age group in "Feverish illness in children" (NICE clinical guideline 47).

Table. Urine-testing Strategies for Infants and Children 3 Months or Older But Younger Than 3 Years

Urgent microscopy and culture is the preferred method for diagnosing UTI in this age group; this should be used where possible.

If the infant or child has specific urinary symptoms	Urgent microscopy and culture should be arranged and antibiotic treatment should be started. When urgent microscopy is not available, a urine sample should be sent for microscopy and culture, and antibiotic treatment should be started.
If the symptoms are non-specific to UTI	<ul style="list-style-type: none">• For an infant or child with a high risk of serious illness: the infant or child should be urgently referred to a paediatric specialist where a urine sample should be sent for urgent microscopy and culture. Such infants and children should be managed in line with "Feverish illness in children" (NICE clinical guideline 47).• For an infant or child with an intermediate risk of serious illness: if the situation demands, the infant or child may be referred urgently to a paediatric specialist. For infants and children who do not require paediatric specialist referral, urgent microscopy and culture should be arranged. Antibiotic treatment should be started if microscopy is positive (see the Table below titled "Guidance on the Interpretation of Microscopy Results"). When urgent microscopy is not available, dipstick testing may act as a substitute. The presence of nitrites suggests the possibility of infection and antibiotic treatment should be started (see the Table below titled "Urine-testing Strategies for Children 3 Years or Older"). In all cases, a urine sample should be sent for microscopy and culture.• For an infant or child with a low risk of serious illness:

	microscopy and culture should be arranged. Antibiotic treatment should only be started if microscopy or culture is positive.
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Table. Urine-testing Strategies for Children 3 Years or Older

Dipstick testing for leucocyte esterase and nitrite is diagnostically as useful as microscopy and culture, and can safely be used.	
If both leucocyte esterase and nitrite are positive	The child should be regarded as having UTI and antibiotic treatment should be started. If a child has a high or intermediate risk of serious illness and/or a history of previous UTI, a urine sample should be sent for culture.
If leucocyte esterase is negative and nitrite is positive	Antibiotic treatment should be started if the urine test was carried out on a fresh sample of urine. A urine sample should be sent for culture. Subsequent management will depend upon the result of urine culture.
If leucocyte esterase is positive and nitrite is negative	A urine sample should be sent for microscopy and culture. Antibiotic treatment for UTI should not be started unless there is good clinical evidence of UTI (for example, obvious urinary symptoms). Leucocyte esterase may be indicative of an infection outside the urinary tract which may need to be managed differently.
If both leucocyte esterase and nitrite are negative	The child should not be regarded as having UTI. Antibiotic treatment for UTI should not be started, and a urine sample should not be sent for culture. Other causes of illness should be explored.

Table. Guidance on the Interpretation of Microscopy Results

Microscopy Results	Pyuria Positive	Pyuria Negative
Bacteriuria positive	The infant or child should be regarded as having UTI	The infant or child should be regarded as having UTI
Bacteriuria negative	Antibiotic treatment should be started if clinically UTI	The infant or child should be regarded as not having UTI

Indication for Culture

Urine samples should be sent for culture:

- In infants and children who have a diagnosis of acute pyelonephritis/upper urinary tract infection
- In infants and children with a high to intermediate risk of serious illness
- In infants and children younger than 3 years

- In infants and children with a single positive result for leucocyte esterase or nitrite
- In infants and children with recurrent UTI
- In infants and children with an infection that does not respond to treatment within 24–48 hours, if no sample has already been sent
- When clinical symptoms and dipstick tests do not correlate.

History and Examination on Confirmed UTI

The following risk factors for UTI and serious underlying pathology should be recorded:

- Poor urine flow
- History suggesting previous UTI or confirmed previous UTI
- Recurrent fever of uncertain origin
- Antenatally diagnosed renal abnormality
- Family history of vesicoureteric reflux (VUR) or renal disease
- Constipation
- Dysfunctional voiding
- Enlarged bladder
- Abdominal mass
- Evidence of spinal lesion
- Poor growth
- High blood pressure

Clinical Differentiation Between Acute Pyelonephritis/Upper Urinary Tract Infection and Cystitis/Lower Urinary Tract Infection

Infants and children who have bacteriuria and fever of 38 degrees C or higher should be considered to have acute pyelonephritis/upper urinary tract infection. Infants and children presenting with fever lower than 38 degrees C with loin pain/tenderness and bacteriuria should be considered to have acute pyelonephritis/upper urinary tract infection. All other infants and children who have bacteriuria but no systemic symptoms or signs should be considered to have cystitis/lower urinary tract infection.

Laboratory Tests for Localising UTI

C-reactive protein alone should not be used to differentiate acute pyelonephritis/upper urinary tract infection from cystitis/lower urinary tract infection in infants and children.

Imaging Tests for Localising UTI

The routine use of imaging in the localisation of a UTI is not recommended.

In the rare instances when it is clinically important to confirm or exclude acute pyelonephritis/ upper urinary tract infection, power Doppler ultrasound is recommended. When this is not available or the diagnosis still cannot be confirmed, a dimercaptosuccinic acid (DMSA) scintigraphy scan is recommended.

Acute Management

Note that the antibiotic requirements for infants and children with conditions that are outside the scope of this guideline (for example, children already known to have significant pre-existing uropathies) have not been addressed and may be different from those given here.

Infants and children with a high risk of serious illness should be referred urgently to the care of a paediatric specialist.

Infants younger than 3 months with a possible UTI should be referred immediately to the care of a paediatric specialist. Treatment should be with parenteral antibiotics in line with "Feverish illness in children" (NICE clinical guideline 47).

For infants and children 3 months or older with acute pyelonephritis/upper urinary tract infection:

- Consider referral to secondary care.
- Treat with oral antibiotics for 7–10 days. The use of an oral antibiotic with low resistance patterns is recommended, for example cephalosporin or co-amoxiclav.
- If oral antibiotics cannot be used, treat with an intravenous (IV) antibiotic agent such as cefotaxime or ceftriaxone for 2–4 days followed by oral antibiotics for a total duration of 10 days.

For infants and children 3 months or older with cystitis/lower urinary tract infection:

- Treat with oral antibiotics for 3 days. The choice of antibiotics should be directed by locally developed multidisciplinary guidance. Trimethoprim, nitrofurantoin, cephalosporin or amoxicillin may be suitable.
- The parents or carers should be advised to bring the infant or child for reassessment if the infant or child is still unwell after 24–48 hours. If an alternative diagnosis is not made, a urine sample should be sent for culture to identify the presence of bacteria and determine antibiotic sensitivity if urine culture has not already been carried out.

For infants and children who receive aminoglycosides (gentamicin or amikacin), once-daily dosing is recommended.

If parenteral treatment is required and IV treatment is not possible, intramuscular treatment should be considered.

If an infant or child is receiving prophylactic medication and develops an infection, treatment should be with a different antibiotic, not a higher dose of the same antibiotic.

Asymptomatic bacteriuria in infants and children should not be treated with antibiotics.

Laboratories should monitor resistance patterns of urinary pathogens and make this information routinely available to prescribers.

Long-term Management

Prevention of Recurrence

Dysfunctional elimination syndromes and constipation should be addressed in infants and children who have had a UTI.

Children who have had a UTI should be encouraged to drink an adequate amount.

Children who have had a UTI should have ready access to clean toilets when required and should not be expected to delay voiding.

Antibiotic Prophylaxis

Antibiotic prophylaxis should not be routinely recommended in infants and children following first-time UTI.

Antibiotic prophylaxis may be considered in infants and children with recurrent UTI.

Asymptomatic bacteriuria in infants and children should not be treated with prophylactic antibiotics.

Imaging Tests

Infants and children with atypical UTI (see the Table below titled "Definitions of Atypical and Recurrent UTI") should have ultrasound of the urinary tract during the acute infection to identify structural abnormalities of the urinary tract such as obstruction as outlined in Tables below titled "Recommended Imaging Schedule for Infants Younger Than 6 Months," "Recommended Imaging Schedule for Infants and Children 6 months or Older But Younger Than 3 Years," and "Recommended Imaging Schedule for Children 3 Years or Older." This is to ensure prompt management.

For infants younger than 6 months with first-time UTI that responds to treatment, ultrasound should be carried out within 6 weeks of the UTI, as outlined in the Table below titled "Recommended Imaging Schedule for Infants Younger Than 6 Months."

For infants and children 6 months or older with first-time UTI that responds to treatment, routine ultrasound is not recommended unless the infant or child has atypical UTI, as outlined in the Tables below titled "Recommended Imaging Schedule for Infants and Children 6 months or Older But Younger Than 3 Years" and "Recommended Imaging Schedule for Children 3 Years or Older."

Infants and children who have had a lower urinary tract infection should undergo ultrasound (within 6 weeks) only if they are younger than 6 months or have had recurrent infections.

A DMSA scan 4–6 months following the acute infection should be used to detect renal parenchymal defects as outlined in the Tables below titled "Recommended Imaging Schedule for Infants Younger Than 6 Months," "Recommended Imaging Schedule for Infants and Children 6 months or Older But Younger Than 3 Years," and "Recommended Imaging Schedule for Children 3 Years or Older."

If the infant or child has a subsequent UTI while awaiting DMSA, the timing of the DMSA should be reviewed and consideration given to doing it sooner.

Routine imaging to identify VUR is not recommended for infants and children who have had a UTI, except in specific circumstances as outlined in the Tables below titled "Recommended Imaging Schedule for Infants Younger Than 6 Months," "Recommended Imaging Schedule for Infants and Children 6 months or Older But Younger Than 3 Years," and "Recommended Imaging Schedule for Children 3 Years or Older."

When micturating cystourethrogram (MCUG) is performed, prophylactic antibiotics should be given orally for 3 days with MCUG taking place on the second day.

Infants and children who have had a UTI should be imaged as outlined in the Tables below titled "Recommended Imaging Schedule for Infants Younger Than 6 Months," "Recommended Imaging Schedule for Infants and Children 6 months or Older But Younger Than 3 Years," and "Recommended Imaging Schedule for Children 3 Years or Older."

Table. Definitions of Atypical and Recurrent UTI

Atypical UTI includes:

- Seriously ill (for more information refer to "Feverish illness in children" (NICE clinical guideline 47)
- Poor urine flow
- Abdominal or bladder mass
- Raised creatinine
- Septicaemia
- Failure to respond to treatment with suitable antibiotics within 48 hours
- Infection with non-*Escherichia coli* organisms

Recurrent UTI:

- Two or more episodes of UTI with acute pyelonephritis/upper urinary tract infection
- One episode of UTI with acute pyelonephritis/upper urinary tract infection plus one or more episode of UTI with cystitis/lower urinary tract infection
- Three or more episodes of UTI with cystitis/lower urinary tract infection

Table. Recommended Imaging Schedule for Infants Younger Than 6 Months

Test	Responds well to treatment within 48 hours	Atypical UTI ^a	Recurrent UTI ^a
Ultrasound during the acute infection	No	Yes ^c	Yes
Ultrasound within 6 weeks	Yes ^b	No	No
DMSA 4–6 months following the acute infection	No	Yes	Yes
MCUG	No	Yes	Yes

^aSee the Table titled "Definitions of Atypical and Recurrent UTI," above, for definition.

^b If abnormal consider MCUG.

^cIn an infant or child with a non-*E. coli* UTI, responding well to antibiotics and with no other features of atypical infection, the ultrasound can be requested on a non-urgent basis to take place within 6 weeks.

Table. Recommended Imaging Schedule for Infants and Children 6 Months or Older But Younger Than 3 Years

Test	Responds well to treatment within 48 hours	Atypical UTI ^a	Recurrent UTI ^a
Ultrasound during the acute infection	No	Yes ^c	No
Ultrasound within 6 weeks	No	No	Yes
DMSA 4–6 months following the acute infection	No	Yes	Yes
MCUG	No	No ^b	No ^b

^aSee the Table titled "Definitions of Atypical and Recurrent UTI," above, for definition.

^bWhile MCUG should not be performed routinely it should be considered if the following features are present:

- Dilatation on ultrasound
- Poor urine flow
- Non-*E. coli* infection
- Family history of VUR

^cIn an infant or child with a non-*E. coli* UTI, responding well to antibiotics and with no other features of atypical infection, the ultrasound can be requested on a non-urgent basis to take place within 6 weeks.

Table. Recommended Imaging Schedule for Children 3 Years or Older

Test	Responds well to treatment within 48 hours	Atypical UTI ^a	Recurrent UTI ^a
Ultrasound during the acute infection	No	Yes ^{b,c}	No
Ultrasound within 6 weeks	No	No	Yes ^b
DMSA 4–6 months following the acute infection	No	No	Yes
MCUG	No	No	No

^aSee the Table titled "Definitions of Atypical and Recurrent UTI," above, for definition.

^bUltrasound in toilet-trained children should be performed with a full bladder with an estimate of bladder volume before and after micturition.

^cIn a child with a non-*E. coli* UTI, responding well to antibiotics and with no other features of atypical infection, the ultrasound can be requested on a non-urgent basis to take place within 6 weeks.

Surgical Intervention for VUR

Surgical management of VUR is not routinely recommended.

Follow-up

Infants and children who do not undergo imaging investigations should not routinely be followed up.

The way in which the results of imaging will be communicated should be agreed with the parents or carers or the young person as appropriate.

When results are normal, a follow-up outpatient appointment is not routinely required. Parents or carers should be informed of the results of all the investigations in writing.

Infants and children who have recurrent UTI or abnormal imaging results should be assessed by a paediatric specialist.

Assessment of infants and children with renal parenchymal defects should include height, weight, blood pressure, and routine testing for proteinuria.

Infants and children with a minor, unilateral renal parenchymal defect do not need long-term follow-up unless they have recurrent UTI or family history or lifestyle risk factors for hypertension.

Infants and children who have bilateral renal abnormalities, impaired kidney function, raised blood pressure and/or proteinuria should receive monitoring and appropriate management by a paediatric nephrologist to slow the progression of chronic kidney disease.

Infants and children who are asymptomatic following an episode of UTI should not routinely have their urine re-tested for infection.

Asymptomatic bacteriuria is not an indication for follow-up.

Information and Advice to Children, Young People, and Parents/Carers

Healthcare professionals should ensure that when a child or young person has been identified as having a suspected UTI, they and their parents or carers as appropriate are given information about the need for treatment, the importance of completing any course of treatment and advice about prevention and possible long-term management.

Healthcare professionals should ensure that children and young people, and their parents or carers as appropriate, are aware of the possibility of a UTI recurring and understand the need to be vigilant and to seek prompt treatment from a healthcare professional for any suspected reinfection.

Healthcare professionals should offer children and young people and/or their parents or carers appropriate advice and information on:

- Prompt recognition of symptoms
- Urine collection, storage and testing
- Appropriate treatment options
- Prevention
- The nature of and reason for any urinary tract investigation
- Prognosis
- Reasons and arrangements for long-term management if required

CLINICAL ALGORITHM(S)

A clinical algorithm for "Diagnosis, Treatment and Long-Term Management of Urinary Tract Infection in Infants and Children" is provided in the original guideline document.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of evidence supporting the recommendations is not specifically stated.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Accurate diagnosis and effective treatment and long-term management of urinary tract infection in children

POTENTIAL HARMS

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

- This guidance represents the view of the Institute, which was arrived at after careful consideration of the evidence available. Healthcare professionals are expected to take it fully into account when exercising their clinical judgement. The guidance does not, however, override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or guardian or carer and informed by the summary of product characteristics of any drugs they are considering.
- While every effort has been made to ensure the accuracy of the information contained within this publication, the publisher can give no guarantee for information about drug dosage and application thereof contained in this book. In every individual case the respective user must check current indications and accuracy by consulting other pharmaceutical literature and following the guidelines laid down by the manufacturers of specific products and the relevant authorities in the country in which they are practising.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

The Healthcare Commission assesses the performance of National Health Service (NHS) organisations in meeting core and developmental standards set by the Department of Health in "Standards for better health," issued in July 2004. Implementation of clinical guidelines forms part of the developmental standard D2. Core standard C5 says that national agreed guidance should be taken into account when NHS organisations are planning and delivering care.

National Institute for Health and Clinical Excellence (NICE) has developed tools to help organisations implement this guidance (listed below). These are available on the NICE web site (www.nice.org.uk/CG054) (see also the "Availability of Companion Documents" field).

- Slides highlighting key messages for local discussion
- Costing tools
 - Costing report to estimate the national savings and costs associated with implementation.
 - Costing template to estimate the local costs and savings involved.
- Implementation advice on how to put the guidance into practice and national initiatives that support this locally.
- Audit criteria to monitor local practice.

The National Collaborating Centre for Women's and Children's Health and the Guideline Development Group have also devised an algorithm. This is available on the website (www.nice.org.uk/CG054).

Key Priorities for Implementation

Diagnosis

Symptoms and Signs

- Infants and children presenting with unexplained fever of 38 degrees C or higher should have a urine sample tested after 24 hours at the latest.
- Infants and children with symptoms and signs suggestive of urinary tract infection (UTI) should have a urine sample tested for infection. Table 4.15 in the original guideline document is a guide to the symptoms and signs that infants and children present with.

Urine Collection

- A clean catch urine sample is the recommended method for urine collection. If a clean catch urine sample is unobtainable:
 - Other non-invasive methods such as urine collection pads should be used. It is important to follow the manufacturers' instructions when using urine collection pads. Cotton wool balls, gauze and sanitary towels should not be used to collect urine in infants and children.
 - When it is not possible or practical to collect urine by non-invasive methods, catheter samples or suprapubic aspiration (SPA) should be used.
 - Before SPA is attempted, ultrasound guidance should be used to demonstrate the presence of urine in the bladder.

Urine Testing

- The urine-testing strategies shown in tables 4.16 to 4.19 in the original guideline document are recommended*.

*Assess the risk of serious illness in line with "Feverish illness in children" (NICE clinical guideline 47) to ensure appropriate urine tests and interpretation, both of which depend on the child's age and risk of serious illness.

History and Examination on Confirmed UTI

- The following risk factors for UTI and serious underlying pathology should be recorded:
 - Poor urine flow
 - History suggesting previous UTI or confirmed previous UTI
 - Recurrent fever of uncertain origin
 - Antenatally-diagnosed renal abnormality
 - Family history of vesicoureteric reflux (VUR) or renal disease
 - Constipation
 - Dysfunctional voiding
 - Enlarged bladder
 - Abdominal mass
 - Evidence of spinal lesion
 - Poor growth
 - High blood pressure

Acute Management

Antibiotic Treatment

- Infants younger than 3 months with a possible UTI should be referred immediately to the care of a paediatric specialist. Treatment should be with parenteral antibiotics in line with "Feverish illness in children" (NICE clinical guideline 47).
- For infants and children 3 months or older with acute pyelonephritis/upper urinary tract infection:
 - Consider referral to a paediatric specialist.
 - Treat with oral antibiotics for 7–10 days. The use of an oral antibiotic with low resistance patterns is recommended, for example cephalosporin or co-amoxiclav.
 - If oral antibiotics cannot be used, treat with an intravenous (IV) antibiotic agent such as cefotaxime or ceftriaxone for 2–4 days followed by oral antibiotics for a total duration of 10 days.
- For infants and children 3 months or older with cystitis/lower urinary tract infection:
 - Treat with oral antibiotics for 3 days. The choice of antibiotics should be directed by locally developed multidisciplinary guidance. Trimethoprim, nitrofurantoin, cephalosporin, or amoxicillin may be suitable.
 - The parents or carers should be advised to bring the infant or child for reassessment if the infant or child is still unwell after 24–48 hours. If an alternative diagnosis is not made, a urine sample should be sent for culture to identify the presence of bacteria and determine antibiotic sensitivity if urine culture has not already been carried out.

Long Term Management

Antibiotic Prophylaxis

- Antibiotic prophylaxis should not be routinely recommended in infants and children following first-time UTI.

Imaging Tests

- Infants and children who have had a UTI should be imaged as outlined in tables 6.13, 6.14, and 6.15 in the original guideline document.

IMPLEMENTATION TOOLS

Audit Criteria/Indicators
Clinical Algorithm
Foreign Language Translations
Patient Resources
Quick Reference Guides/Physician Guides
Resources
Slide Presentation

For information about [availability](#), see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness
Patient-centeredness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

National Collaborating Centre for Women's and Children's Health. Urinary tract infection in children: diagnosis, treatment and long-term management. London (UK): National Institute for Health and Clinical Excellence (NICE); 2007 Aug. 148 p. (Clinical guideline; no. 54). [271 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

2007 Aug

GUIDELINE DEVELOPER(S)

National Collaborating Centre for Women's and Children's Health - National Government Agency [Non-U.S.]

SOURCE(S) OF FUNDING

National Institute for Health and Clinical Excellence (NICE)

GUIDELINE COMMITTEE

Guideline Development Group

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

All Guideline Development Group (GDG) members' interests were recorded on a standard declaration form that covered consultancies, fee-paid work, shareholdings, fellowships, and support from the healthcare industry in accordance with guidance from the National Institute for Health and Clinical Excellence (NICE).

GUIDELINE STATUS

This is the current release of the guideline.

GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) format from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#).

AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- Urinary tract infection in children. Urinary tract infection in children: diagnosis, treatment and long-term management. NICE guideline. London (UK): National Institute for Health and Clinical Excellence; 2007 Aug. 30 p. (Clinical guideline; no. 54). Electronic copies: Available in Portable Document Format (PDF) from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#).
- UTI in children. Urinary tract infection in children: diagnosis, treatment and long-term management. Quick reference guide. London (UK): National Institute for Health and Clinical Excellence; 2007 Aug. 15 p. (Clinical guideline; no. 54). Electronic copies: Available in Portable Document Format (PDF) from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#).
- Diagnosis, treatment and long-term management of urinary tract infection in infants and children. Algorithm. London (UK): National Institute for Health and Clinical Excellence; 2007 Aug. 4 p. (Clinical guideline; no. 54). Electronic copies: Available in Portable Document Format (PDF) from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#).
- CG54 Urinary tract infection in children: diagnosis, treatment and long-term management. Slide set. London (UK): National Institute for Health and Clinical Excellence; 2007 Aug. 33 p. (Clinical guideline; no. 54). Electronic copies: Available in Portable Document Format (PDF) from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#).

- Urinary tract infection in children: diagnosis, treatment and long-term management. Implementation advice. London (UK): National Institute for Health and Clinical Excellence; 2007 Aug. 19 p. (Clinical guideline; no. 54). Electronic copies: Available in Portable Document Format (PDF) from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#).
- Urinary tract infection in children: diagnosis, treatment and long-term management. Costing template. London (UK): National Institute for Health and Clinical Excellence; 2007 Aug. (Clinical guideline; no. 54). Electronic copies: Available in Portable Document Format (PDF) from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#).
- Urinary tract infection in children: diagnosis, treatment and long-term management. Costing report. London (UK): National Institute for Health and Clinical Excellence; 2007 Aug. 31 p. (Clinical guideline; no. 54). Electronic copies: Available in Portable Document Format (PDF) from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#).
- Urinary tract infection in children: diagnosis, treatment and long-term management. Audit criteria. London (UK): National Institute for Health and Clinical Excellence; 2007 Aug. 19 p. (Clinical guideline; no. 54). Electronic copies: Available in Portable Document Format (PDF) from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#).
- The guidelines manual 2007. London (UK): National Institute for Health and Clinical Excellence (NICE); 2007 April. Electronic copies: Available in Portable Document Format (PDF) from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#).

Print copies: Available from the National Health Service (NHS) Response Line 0870 1555 455. ref: N1304. 11 Strand, London, WC2N 5HR.

PATIENT RESOURCES

The following is available:

- Urinary tract infection (UTI) in children. Understanding NICE guidance. Information for people who use NHS services. National Institute for Clinical Excellence (NICE), 2007 Aug. 12 p.

Available in [English](#) and [Welsh](#) in Portable Document Format (PDF) from the National Institute for Health and Clinical Excellence (NICE) Web site.

Print copies: Available from the National Health Service (NHS) Response Line 0870 1555 455, ref: N1305. 11 Strand, London, WC2N 5HR.

Please note: This patient information is intended to provide health professionals with information to share with their patients to help them better understand their health and their diagnosed disorders. By providing access to this patient information, it is not the intention of NGC to provide specific medical advice for particular patients. Rather we urge patients and their representatives to review this material and then to consult with a licensed health professional for evaluation of treatment options suitable for them as well as for diagnosis and answers to their personal medical questions. This patient information has been derived and prepared from a guideline for health care professionals included on NGC by the authors or publishers of that original guideline. The patient information is not reviewed by NGC to establish whether or not it accurately reflects the original guideline's content.

NGC STATUS

This summary was completed by ECRI Institute on April 3, 2009.

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